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CALIBRATION GUIDE
DOCUMENT #W77

pH Electrode Calibration Guide

Electrode calibration is necessary in order to establish the slope and zero point of the electrode. Since both of these can change over time, frequent calibration is necessary.

The frequency of calibration depends on the application, with some applications requiring daily calibration while others may require only weekly or monthly calibration. More frequent calibration is recommended when measuring in heavily contaminated, low-ion, strongly acidic, and high temperature solutions.

To ensure an accurate calibration, the following steps are recommended.

1. Check the age of the electrode

pH electrodes generally last 12-18 months. This holds true whether the electrode is being used or not.

The lot code will determine the age of your pH electrode. A lot code is two numbers, followed by a letter. The numbers indicate the year of manufacture and the letter indications the month, i.e. A=January, B=February, C=March etc. Please note that the letter "I" is not used, this means H=August and J=September and so on.

Example: 15A indicates the electrode was manufactured in January 2015

2. Perform routine maintenance

Keeping an electrode clean can help eliminate calibration issues. pH electrodes usually require weekly or monthly cleaning. Always check the meter and electrode manuals for calibration and routine maintenance information.

Field electrodes:
Regularly soak the electrode in a 1:1 bleach water solution for 15-30 minutes to reduce the chances of a clogged reference junction.

If hard deposits (e.g. barnacles) have built up on your electrode, you can clean these by soaking the electrode in 1M (molar) HCl (hydrochloric acid) for ~3 minutes. Vinegar can also be used, but will require a longer period of soaking to remove hard deposits.

Lab electrodes:
Place the electrode for ~5 minutes in 0.1 M HCl or 0.1 M NaOH. If the buildup is not removed, the solution should be cautiously heated up to 50 °C before the acid or alkaline concentration is increased.

3. Check for damage to the electrode

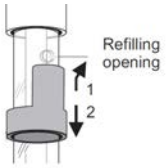
The electrode must be replaced if the glass bulb at the tip of the electrode has been damaged or if the electrode body (plastic or glass) has been damaged.

4. Check the temperature sensor

Since the electrode slope is dependent upon the temperature of the solution, it is very important that pH measurements be completed with an accurate temperature sensor.

5. Open the refill slider/stopper

For YSI lab electrodes featuring a refillable reference, the first step to calibrating and/or taking a measurement is to open the refill opening. Depending on the model, the refill opening is either a slider (left image) or a stopper (right image). The refilling opening must always be open during calibration and measurement!



6. Check the electrolyte level

For refillable electrodes, ensure the fill level of the electrolyte is at least 2 cm above the level of the measurement solution. Replace the electrolyte if it has become contaminated.

7. Use fresh, unused, unexpired buffers

Once buffers are used for calibration, they are assumed contaminated and should not be used again. Reusing buffers can lead to slow pH electrode response or the inability to calibrate. The cause of calibration failure is difficult to determine if the pH buffers have already been used. Used buffer solutions can be kept for rinsing the calibration container and the electrode between calibration points.

Expired buffer solutions should not be used and buffer bottles should not be left open. Carbon dioxide in the air can change the pH of basic buffer solutions, so basic buffer bottles should only briefly be opened. Use opened containers of buffer as soon as possible.

8. Perform at least a 2-point calibration

It is best to perform at least a 2-point calibration and pH 7 buffer must be one of those points. The pH buffers used should differ by at least two pH units and should bracket the expected in situ pH conditions. Unless the sample is expected to be above pH 7, basic buffers should not be used, as their pH value quickly changes by absorbing CO_2.

3-point calibrations are typically completed when the sample pH conditions are not well understood. Asymmetry and slope are determined for both 2 and 3-point calibrations.

A 1-point calibration will only determine the zero point, not the electrode slope. The range of use of 1-point calibrations is limited and should only be completed with pH 7 buffer. The pH value obtained can be used to compare to previous results, but is not an absolute value.

9. The first calibration point should be pH 7

Although it is not always required, it is best to begin calibration with pH 7 buffer.

10. Confirm the electrode has not dried out

A pH electrode that has been allowed to dry out may need to be replaced. Therefore, ensure the electrode has been properly stored by checking the procedures in the meter and/or electrode manuals.

11. If possible, reset to default calibration

Not all instruments are equipped with this ability, but reverting back to default calibration can help remove calibration error warnings. Please consult the user manual to restore the default calibration, as this process can vary depending on the instrument.

12. Confirm response time in each buffer

Place the electrode in each buffer solution. A stable reading should be reached within ~60 seconds. A slow response suggests the electrode is old or dirty.

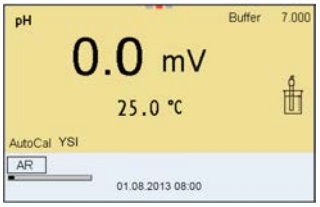
13. Check the selected buffer set

The pH values of buffer solutions are temperature dependent and the response can vary from manufacturer to manufacturer. Also, the pH values of buffers in a buffer set can vary from one set to another. Modern pH meters automatically adjust for the respective temperature profile once the buffer set used has been correctly set.

14. Check the millivolts in each buffer

Rather than displaying pH values, it is best to display mV values on the instrument when checking the sensor performance or calibrating. Not all instruments have this capability, but some instruments do (e.g. the YSI MultiLab and TruLab 1310/1320). The observed mV values in each buffer should be as follows:

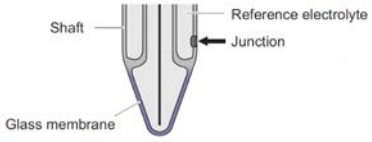
- Buffer 7 should be -50 to 50 mV.



- Buffer 4 should be 165 to 180 mV away from the buffer 7 mV value in the positive direction.
- Buffer 10 should be 165 to 180 mV away from the buffer 7 mV value in the negative direction.

15. The junction and temperature sensor should be immersed

The reference junction must be completely submerged in solution. The temperature sensor must also be in solution in order to accurately compensate pH for temperature.



16. NEVER accept out-of-range or questionable calibrations

Any data collected with an electrode that has a poor calibration result will likely not be usable.

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